

**LESSON 2B—NARRATIVE: WHAT
WERE THE ENVIRONMENTAL
CONDITIONS OF THE HUMAN PAST?**

Archaeologists believe modern human origins and the later arrival of people in North America took place during the Ice Ages. Think about the coldest and snowiest day you remember. Imagine having no house, but instead a cave or a shelter of branches and hides in which to live. You cannot visit a grocery store to buy food. You must depend on dried plants that you harvested during a warmer time of year. You also eat meat preserved from the animals you have hunted. You hope that you have enough to last through the entire cold season. No thermostat turns up the heat in your home. Instead, you build a fire for warmth and protection from the natural elements. Surviving the cold and winter storms can be difficult, but you manage to survive. This was the way of life for Montana's first inhabitants.

By studying past living conditions, archaeologists find clues that help them reconstruct past lifeways. Archaeologists study Ice Age environmental conditions to gain knowledge of the lifeways of the earliest humans. The Ice Ages began about a million and a half years ago. Current geological research, conducted through study of sea floor sediments, indicates that there have been a series of at least seventeen major **glacials**. Each glacial, a period of increased cold and ice formation, was followed by an **interglacial**, or warming trend. Each Ice Age glacial and interglacial cycle

The human past included Ice Age environmental conditions.

lasted for approximately 100,000 years, with the glacial period typically lasting longer than the interglacial. The most recent glacial period ended about 10,000 years ago. Some geologists believe the Ice Ages have ended. Others believe we are currently experiencing an interglacial.

The Ice Ages are known as the **Pleistocene Epoch** on the geologic time scale. Our present time, which began about ten thousand years ago, is called the **Holocene Epoch**, or recent time. During the Holocene Epoch, our climate has fluctuated but remained much the same. Both the Pleistocene and Holocene epochs belong to the **Quaternary Period** in geological time. The locations of the continents in present times are relatively close to the locations they had during the Ice Ages, but the extent of ice and the levels of the seas have fluctuated greatly.

A glacial period began with an increase in precipitation as snowfall. During glacials, Ice Age temperatures dropped an average of seven to ten degrees below current trends. Over hundreds of years, this weather pattern created ice sheets, or **glaciers**, in high mountains and across much of the land in northern latitudes. Glaciers grew and spread as colder weather continued for more hundreds of years. The huge ice sheets originated in northern regions and moved southward. Most of northern Europe, Asia, and North America was covered with glaciers. At the same time, the oceans became shallower as the earth's

waters froze. The glacial Ice Age climate in Montana was similar to that of modern day Alaska, complete with **tundra** and **taiga**. Tundra is an arctic, treeless plain, and taiga is a subarctic forest of conifers.

The Ice Age is of great interest to many different scientists because it was the latest major change in the earth's climate. Ice Age geology and environmental conditions are easier to study and decipher because the evidence is much newer than the changes that occurred further back in Earth's time. Understanding past environmental changes helps us prepare for future challenges of a similar nature. The glacial areas that still exist on Earth can be found only in a few high latitudes and high altitudes. Greenland and Antarctica are year-round examples of glacial environments. The Arctic Ocean is permanently frozen, just as the northern Ice Age waters were. The Himalayas, Alps, Rockies, and Southern Andes Mountains all contain mountain glaciers today. Glacier National Park in Montana is an excellent example of an Ice Age climate. Scientists study and research environmental conditions in these places to learn about the past.

The most recent glacial in North America was the **Wisconsinan Glaciation**. It began about 100,000 years ago. Two giant ice sheets were present on our continent. The **Laurentide** glaciers spread over northeastern Canada and the United States, all the way from the Atlantic coast west to Alberta, Canada. In Montana they extended as far south as the current course of the Missouri River. At the same time, the

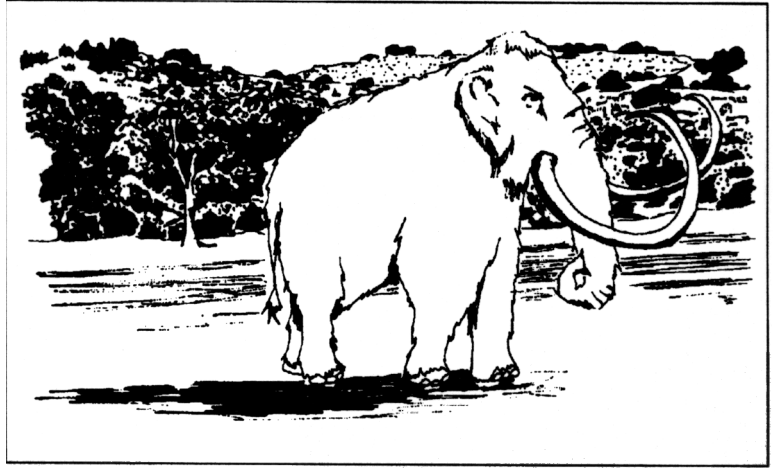
Cordilleran glaciers covered the northern Rocky Mountains west to the Pacific Ocean. In some places, these glaciers could be one mile high. That is higher than any structure ever built by man. The surrounding ice fields may have been two miles high. The ice sheets covering northern North American mountains looked like giant, white rivers of ice.

The weight of glacial ice pushed downward. Water melting between the ice and bedrock made an excellent surface for movement. Everything that was in the path of a glacier became surrounded by ice. Large rocks carried within a glacier scraped and grooved the surface of the land. When a glacier moves, it is like a bulldozer. It forces everything in front of it upward and out to the edges of the ice sheet. Glaciers sculpted the landscape and created new terrain over many thousands of years.

Interglacials could last as long as a glacial, up to 100,000 years, but they generally tended to be shorter-lived. As an interglacial began, temperatures rose a few degrees, and the ice sheets began to melt, or retreat. Rock and soil, formerly trapped in the ice and carried a considerable distance from their point of origin, were left behind on Montana's landscape as large boulders and entire ridges. As the melting proceeded, the glaciers became like icebergs on land. Ice dams and melting water created large lakes. One piece of evidence that a glacier has passed is basement rock that has been scoured or polished. Melt water left gravels and sand far beyond the front of the receding ice. "Potholes" and the rolling topography of the Hi-Line in Montana are glacial remains.

The most recent Ice Age deposited the thick, rich soils of our plains states. With alternating cold and warming trends, a great variety of edible plants were available at any given time in most of Montana. These food sources provided nourishment for a long list of animals. Both flora and fauna migrated with the changing seasons and climate. Animals followed the vegetation changes. If an animal depended on a certain plant to live, and that plant became extinct, the animal did not survive.

Most of the animal fossil remains in the Western Hemisphere are from the Pleistocene Epoch. **Megafauna**, animals weighing more than one hundred pounds, prevailed during the Ice Ages. Species of saber-toothed tigers, bear-sized beaver, and large ancient bison roamed the Ice Age plains. Ancestral camels and horses also lived in Montana during some periods. Megafauna included teratorns, a vulture-like bird with a wingspan of fifteen feet! Lions of the past were much larger than those of today. And the antlers of ancient moose measured eight feet across. Much of the Pleistocene megafauna became extinct at the end of the last glaciation, around 12,000 to 10,000 years ago. Changes in environmental conditions may have caused their disappearance. Some believe that early hunters, arriving in North America at the end of the last Ice Age, may have been overzealous in hunting these animals. Other scientists speculate that other factors—a drought or flood, competition with other animals, epidemics and parasites, or a meteorite catastrophe—may have caused the extinction of the megafauna.



More than likely, a combination of some of these events occurred.

The most famous of the Ice Age megafauna are the **woolly mammoths** whose remains are found in locations all over the world. A fully grown woolly mammoth weighed as much as 16,000 pounds and stood fourteen feet tall at the shoulder! The flesh of a woolly mammoth could feed a family for one year, as long as the meat did not spoil. The woolly mammoth originated in North America and migrated elsewhere. The **mastodon**, another elephant-like animal that people often confuse with a mammoth, migrated to our continent from Asia. Both were hunted by the earliest ancient people in North America. Woolly mammoths were also illustrated by ancient artists in Old World cave paintings.

When scientists study past environmental conditions, they search for clues that might help us with our current problems. Many animals of 10,000 years ago are closely related to those of today. The extinction during the Pleistocene Epoch is the first major extinction with humans on the scene. More than one hundred species of plants and animals became extinct 6,000 to 10,000 years ago. By understanding patterns of

The mammoth was one of many large mammals that disappeared from Montana at the end of the last Ice Age, about ten thousand to twelve thousand years ago. Some archaeologists believe that hunting by Paleoindians contributed to the mammoth's extinction. *Courtesy Lolo National Forest*

human involvement, we may acquire knowledge regarding the evolution and extinction of future species. New species of plants and animals develop along ocean floors and deep in rain forests. While the extinction of species is a natural occurrence, human encroachment on habitats, and the hunting of endangered animals, may cause premature extinction.

Human progress impacts our

earth. Studies of global warming indicate major changes in the environment. Some alterations result naturally, while others are the product of human activities. Understanding the effect humans have had on the earth through time, as well as understanding the effect the environment and climate have had on humans, may offer us valuable guidance for future changes and challenges.

LESSON 2B—VOCABULARY: WHAT WERE THE ENVIRONMENTAL CONDITIONS OF THE HUMAN PAST?

Cordilleran _____

glacial _____

glacier _____

interglacial _____

Holocene Epoch _____

Laurentide _____

mastodon _____

megafauna _____

Pleistocene Epoch _____

Quaternary Period _____

taiga _____

tundra _____

Wisconsinan Glaciation _____

woolly mammoth _____

LESSON 2B—ARCH ACTIVITY: GLACIAL GUTTERS

Grades: 3–8

Time: 40 minutes and overnight

Content Area: science, and writing

Who: whole group and individual

Materials:

two metal bread pans

gravel and rough stones

piece of wood, about 8" x 20"

cardboard box

water

freezer

Arch Journal

OBJECTIVES AND OUTCOME

- Students will see glacial action in two forms, smooth and rough.
- Students will create two glaciers, observe their movement, and write sentence comparisons.

ACTIVITY

1. Fill metal pans halfway with cold water. Add gravel and rough stones to one, covering the bottom. Make sure the other is filled with water to the same level.
2. Freeze overnight. Make sure they are level in freezer.
3. The next day, remove from freezer and let sit for 15 minutes. Remove ice from the pans.
4. Lean the piece of wood against the box to act as a mountain slope.
5. Test both glaciers to observe movement. Instruct students to write sentences comparing the movement of the smooth glacier to that of the rough glacier. (Students should find the smooth glacier moves more readily than the rough due to friction created by the stones and gravel.)

EXTENSIONS

3–8:

- Research vocabulary.

See: Lesson 2B—Vocabulary

- Research ice ages and glaciation.
- Identify and discuss the following terms: cirque, glaciated valleys, erratics, drumlins, eskers, moraine, hanging valleys, crevasses, tarns.
- Research glaciers in the world today (Glacier National Park, Banff-Jasper Parks).
- Research glacial Lake Missoula.

LESSON 2B—ARCH ACTIVITY: RISING WATERS

Grades 3–8

Time: 20 minutes or longer

Content Area: science and writing

Who: whole group

Materials:

large clear bowl

two trays of ice cubes

ruler

Arch Journal

OBJECTIVE AND OUTCOME

- Students will gain knowledge of the fluctuating ocean water levels during the Ice Ages.
- Students will observe and write about the changes that occur as ice is added to water.

ACTIVITY

1. Fill bowl half-way with hot water. Measure water height. Add two trays of ice cubes.

2. Wait for the ice to melt, and measure the water height again. (Note: It may take the ice some time to melt, and the students may need to revisit the bowl later in the day to measure).

3. Compare the change in water level in the bowl, as the ice melts, to that during the Ice Ages as water that was landlocked in glaciers melted. Instruct students to write a paragraph about the changes in the coastline of a continent as the water levels varied during an Ice Age.

EXTENSIONS

3–8:

- Research vocabulary.

See: Lesson 2B—Vocabulary

- Research the volume of water currently frozen in glaciers and ice.
- Research global warming and the effect it may have on our world.